

Amendments to the Drawings:

Drawing FIG. 1 has been amended to remove reference numeral 109 and the associated item.

Attachment: One replacement drawing sheet.

REMARKS

Claims 12-14 and 17-18 have been amended. Claims 1-11 and 19-23 have been canceled without prejudice or disclaimer. New claims 24-36 have been added. Accordingly, claims 12-18 and 24-36 are now pending.

Drawings

The drawings were objected to as containing reference number 109 in FIG. 1 which is not discussed in the specification. In response, this reference number and the associated item have been deleted.

35 U.S.C. §§102 and 103

Claims 1, 6, 11 and 19 stand rejected under 35 U.S.C. §102(e) as being anticipated by Martin et al., US Pat. No. 6898688, (hereafter "Martin"). Claims 2-5, 7-10 and 20-23 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Martin in view of Sim et al., US Pat. App. Pub. No. 20020133491 (hereafter "Sim"). Claims 12-14 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Martin in view of Lo et al., US Pat. No. 5857207 (hereafter "Lo"). Claims 15-18 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Martin in view of Lo, and further in view of Sim. Applicants respectfully traverse these rejections, and request reconsideration and withdrawal of the rejections for the reasons set forth below.

Applicants' invention is able to prevent overflow of a journal storage in a storage system that uses journaling for data backup and recovery. A threshold value of available capacity is set for the journal storage and monitored prior to each journal entry. If the available journal storage capacity falls below the threshold, the storage of new journal entries is stopped, and the controller switches to using bitmap management instead of journal storage until additional capacity is added to the journal storage. (See, e.g., Applicants' specification at page 20, line 1, through page 21, line 3, and FIGS. 6, 12.)

Martin teaches methods for replicating data written to a primary storage system using journaling and snapshot techniques. However, Martin does not teach monitoring the capacity of the journal storage to prevent overflow, or preventing overflow when the capacity falls below a specified threshold by stopping journal storage and switching to bitmap management.

Martin's method includes a primary storage device 108, a forward journal 402, a backward journal 404, and a "mirror in the middle" (MIM) 400, which is an initial copy of a primary storage device 108. Forward journal 402 contains the entire sequence of write commands issued since MIM 400 was identical with primary storage device 108. After the passage of a certain period of time, either a pre-defined time interval or when the portion of random-access storage 114 devoted to forward journal 402 is exhausted of space, a portion of the archived commands in forward journal 402 consisting of the oldest command in the journal and some number of commands following the oldest command in sequence, up to a point in

time determined by the archiving policy are combined so as to obtain a net change taking place during the time period (col. 6, lines 31-40 of Martin). An inverse of the net change is then recorded as a "snapshot" in backward journal 404, while MIM 400 is updated to reflect the determined net change (col. 6, lines 57-59). The portion of the forward journal that was used to update the MIM 400 is then relieved or recycled to make room for new incoming journal transactions (col. 10, lines 15-18), and the journal entries are overwritten and thereby deleted.

Under Applicants' invention, however, the capacity of the journal storage is monitored at the time of receiving a write operation to determine whether the capacity is below a specified threshold value. If the capacity is below this threshold, the storage of new journal entries is stopped, and the storage controller switches to bitmap management instead of just continuing to store new journal entries in the usual fashion. In this manner, the journal storage is not subject to being overwritten, but instead new capacity can be added to the journal pool so that subsequent journal entries can again be stored in the usual fashion. Thus, unlike Martin, Applicants' claimed invention does not require taking a snapshot and overwriting of the journal with new journal entries whenever the journal volume becomes full.

Claim 12 was rejected over the combination of Martin in view of Lo. Lo teaches a storage manager that uses a data structure for organizing storage in a storage system. Lo discusses the use of a bitmap 1910 as part of a header 1902, however, it is respectfully submitted that the cited portion of Lo (col. 44, lines 41-43)

bears little relevance to Applicants' invention. Lo fails to make up for the shortcomings in Martin discussed above.

Further, Sim in combination with Martin and Lo was cited in the rejection of claims 15-18 for teaching a threshold value set in a management table. However, while Sim does disclose use of a PruningThreshold and an AlarmThreshold, Sim fails to make up for the shortcomings discussed above with respect to Martin and Lo. Namely, none of the cited references, taken singly, or in combination teach stopping storage of journal entries to a journal pool when the capacity is below a specified threshold, and switching to bitmap management. These references also fail to teach adding additional storage media to the storage pool following this event, or taking of a logical snapshot following this event. Accordingly, claim 12 is patentable over the cited references. New independent claims 24 and 31 claim subject matter similar to claim 12, and are also allowable for the reasons discussed above. The remaining claims depend from these claims, and are allowable at least because they depend from an allowable base claim.

Conclusion

In view of the foregoing, Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Colin D. Barnitz", written in a cursive style.

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